

The Loci Multidisciplinary Simulation System

Status and Update

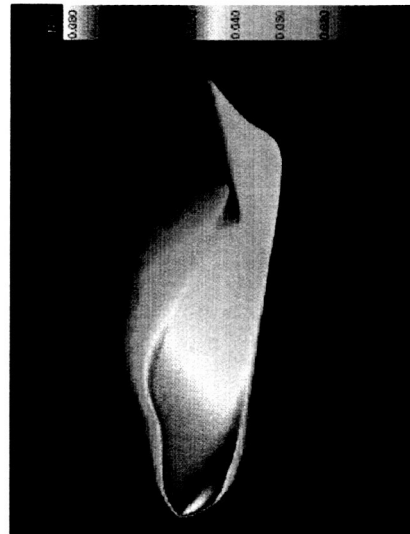
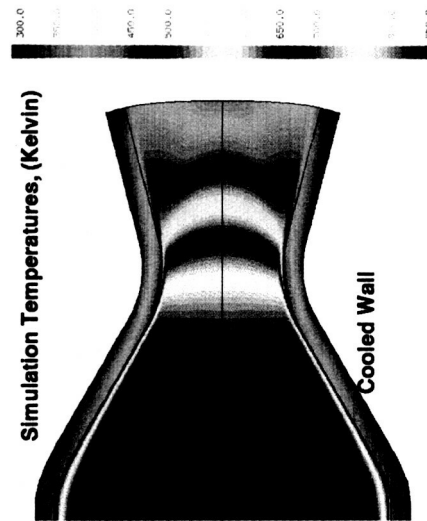
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●●● | Outline of Topics

- An Overview of the Loci Multidisciplinary Simulation System
- Topologically adaptive mesh generation
- Multidisciplinary simulations using Loci with the CHEM chemically reacting flow solver

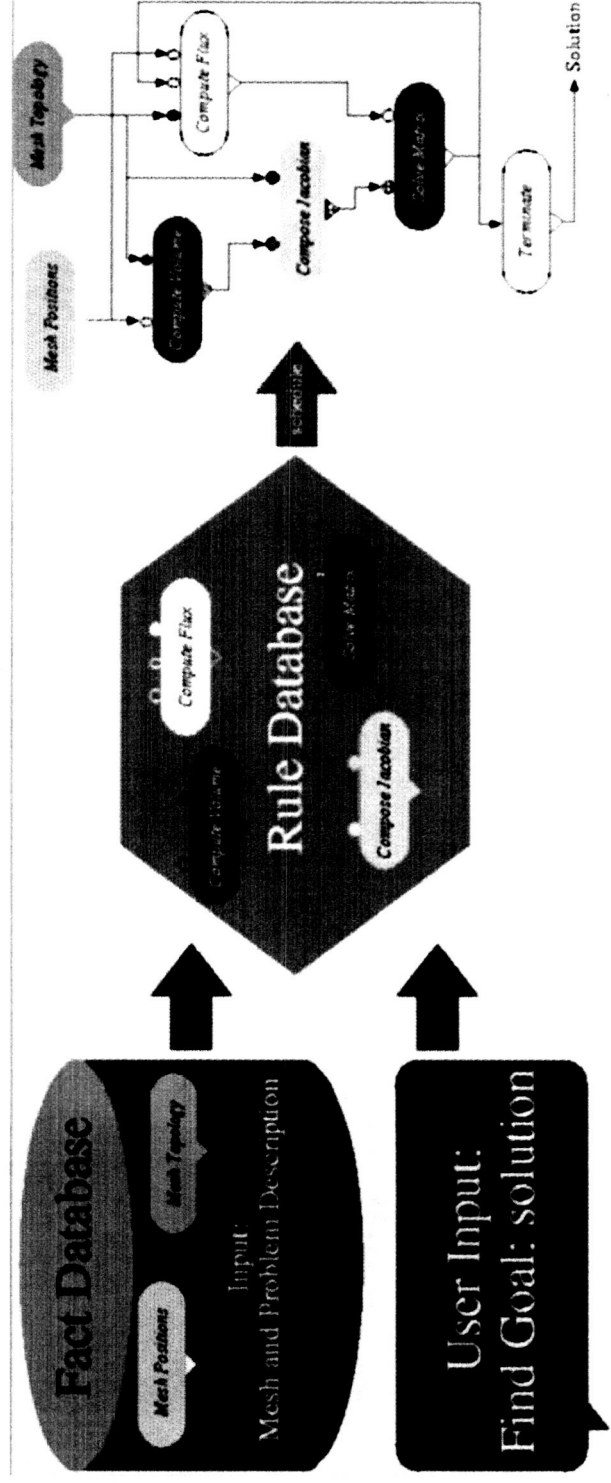
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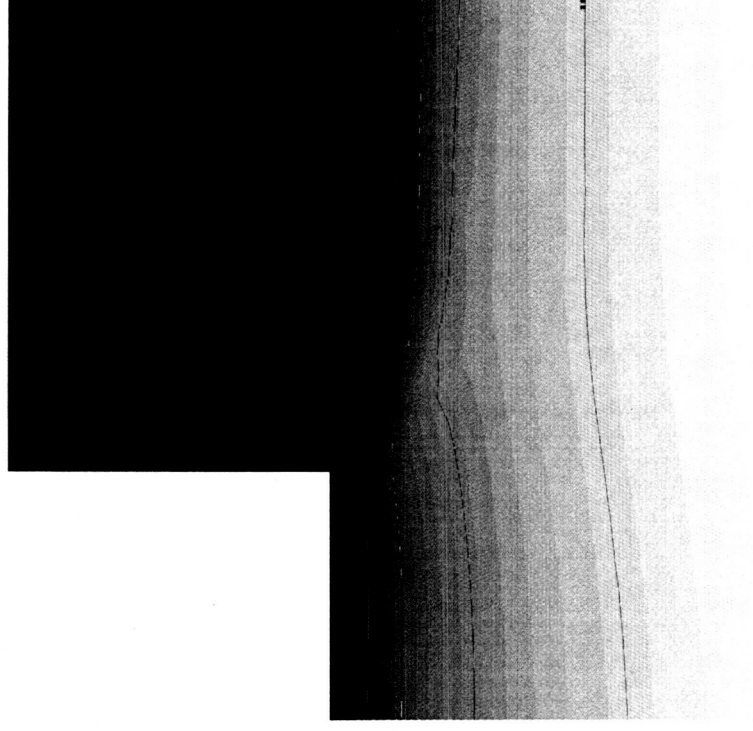
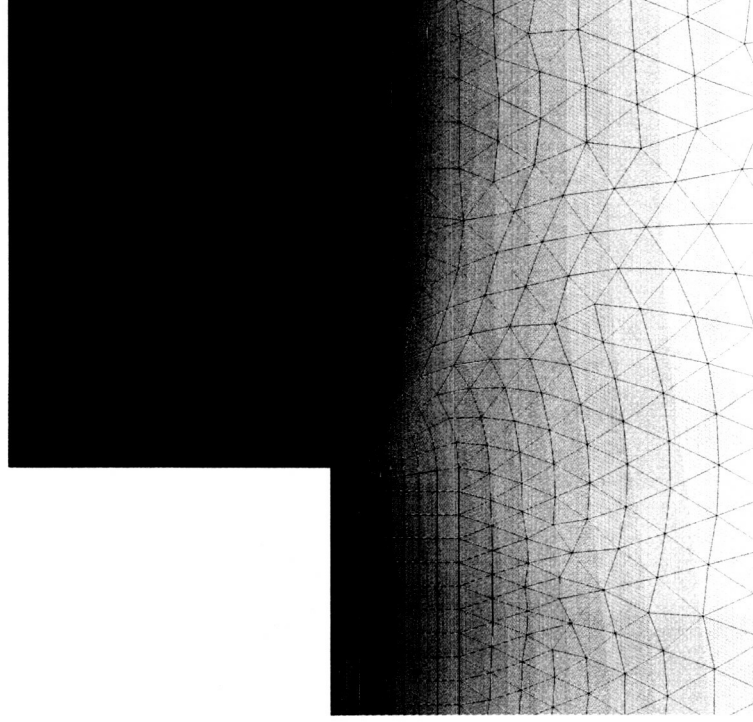
●●● | Loci: What is Simulation Synthesis?

- Applications are described by a collection of computational rules
- Computational rules have simple semantics (fundamental components)
- Rules are automatically synthesized into applications based on inputs and user query
- Synthesized application is checked for logical consistency and is transparently able to use parallel computers such as distributed memory commodity clusters.

Loci: Applications as Knowledge Repositories



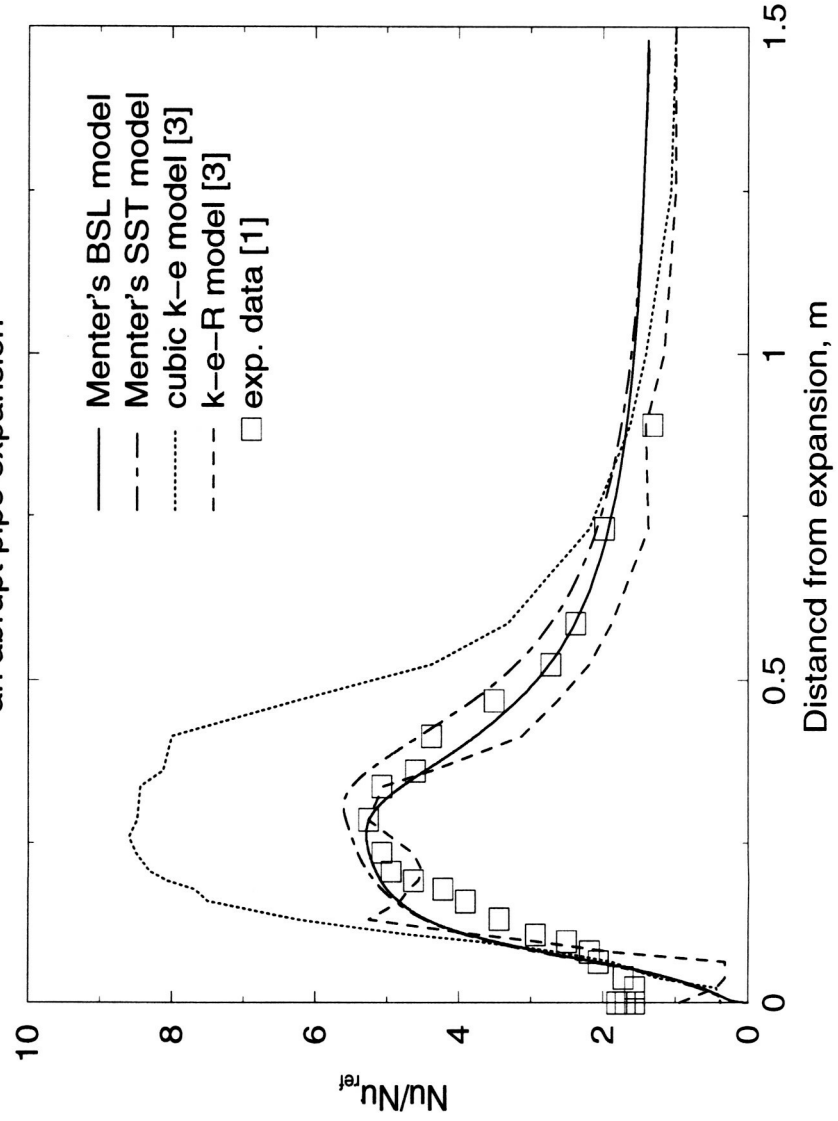
Finite Volume Solution Method on Arbitrary Polyhedra



Validation of Numerical Results

Heat Transfer downstream of

an abrupt pipe expansion



Low Speed Combustion using Preconditioned Reactive Roe Flux

- Uses robust Chorin-Turkel preconditioning method
- Time derivatives in conservative variables
- Newton Iterations transformed to primitive variables (gauge pressure, Temperature, velocity, mass fractions)

●●●| Laminar Methane Flame

- A low speed combustion flow case is used to validate low speed capabilities
- Preconditioning + new time integration method used for numerical model
- Flame simulation neglected radiation and used a reduced mechanism (global) reaction model for methane combustion
- Results of flame height and temperatures similar to results of Smooke (used detailed reaction model, no radiation)
- Results compare well to experiments